PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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Serial No.: 09/350,858)Group Art Unit: 1742
Filed: July 9, 1999)Examiner: Tima M. McGuthry-Banks
Appellants: Men Glenn Chu et al)Attorney Docket: 97-2166
For: Metal Product Containing Ceramic)
Dispersoids Formed In-Situ)

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patent and Trademarks, Washington, D.C. 20231 on November 13, 2001.

Douglas G. Glantz, Reg. No. 29,840
Date of Signature: November 13, 2001

Commissioner for Patents
Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

APPEAL BRIEF

This Appeal Brief is submitted in triplicate as an appeal from the Office Action Final rejection of Appellants' claims mailed March 15, 2001 and pursuant to the Notice of Appeal mailed September 14, 2001 in the above-identified patent application. Final rejection of Claims 18-23 and 25 is hereby appealed. An oral hearing will be requested after the Examiner's Answer as provided in 37 C.F.R. §1.194(b).

I. HISTORY OF CASE

On March 15, 2001, a final Office Action was mailed regarding the above-identified patent application. The Office Action granted a shortened statutory period for response set to expire within three (3) months of the date of the mailing of the letter.

There was no amendment filed after Final.

On September 14, 2001, pursuant to 37 C.F.R. §§ 1.136(a) and 1.191, Appellants filed a petition for a three-month extension of time and a Notice of Appeal to the Board of Patent Appeals and Interferences.

Accordingly, the filing of this Appeal Brief is timely, and Appellants respectfully request consideration of the matters set forth herein.

II. REAL PARTY IN INTEREST

Aluminum Company of America is the real party in interest. Aluminum Company of America is the assignee of the entire right, title, and interest in and to the above-identified U.S. patent application. Assignment of the Inventors' Rights in the present patent application to Aluminum Company of America is evidenced by the assignment document which was recorded in the U.S. Patent and Trademark Office on November 25, 1997 at Reel No. 8872, Frame 0804.

III. RELATED APPEALS AND INTERFERENCES

There are no related applications that are currently on appeal or in an Interference that are known to the Appellant, the Appellants' legal representative, or assignee which will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

IV. STATUS OF THE CLAIMS

Claims 18-25 are pending in the application.

Claim 24 is cancelled as a duplicate of Claim 22.

Claims 18-23 and 25 were finally rejected and are the subject of this appeal. The claims are reproduced in Appendix A.

V. STATUS OF AMENDMENT AFTER FINAL

No Amendment After Final was filed.

VI. SUMMARY OF THE INVENTION

The present invention provides a novel method for producing a ceramic phase particle dispersoid in metal and a novel product composed thereof. The method includes (a) providing a molten composition consisting essentially of molten aluminum alloy and molten metal selected form the group consisting of Zr, V and

combinations thereof; (b) providing a chloride salt containing fine carbon particles; and (c) reacting the chloride salt containing fine carbon particles in the molten aluminum metal liquid with the molten metal liquid to form a uniform distribution of finely sized carbide particles formed and dispersed in-situ in an aluminum alloy matrix.

The step of reacting includes vigorously stirring the mixture containing salt, metal alloy, and carbon to form a reaction mixture at a temperature above the liquidus of alloy to form a uniform distribution of particles sized less than about 2.5 microns uniformly dispersed in-situ in the metal matrix.

Another embodiment of the invention is a ceramic dispersoid in metal product comprising: (a) a matrix metal; and (b) a uniform distribution of formed and dispersed in-situ in the metal matrix. The finely sized ceramic particles are formed by the process of (i) providing a molten composition comprising a matrix liquid of aluminum or aluminum alloy metal and at least one carbide-forming element selected from the group consisting of Ti, Sc, Hf, Nb, Zr, Mo, and V; (ii) providing a chloride salt containing carbon particles, wherein the salt comprises NaCl and KCl in a weight/weight ratio within the range of about 0.8-1.2 and of $MgCl_2$ and $CaCl_2$ in amounts comprising rip to about 5-10% by weight of the salt mixture; and (iii) reacting the chloride salt

containing carbon particles in the molten aluminum alloy by vigorously stirring the aluminum alloy and the chloride salt containing carbon particles to form a mixture of the molten metal liquid in contact with a portion of the carbon particles at an elevated temperature above the liquidus of the aluminum alloy to form a unagglomerated distribution of finely sized ceramic phase particles having an average particle diameter of less than about 0.3 microns formed and dispersed in-situ in an aluminum metal matrix.

VII. ISSUES

Issue 1:

Whether Claims 18, 20-23 and 25 are anticipated under 35 U.S.C. §102(b) based on Nagle et al. U.S. Patent 4,915,908 (hereinafter "Nagle").

Issue 2:

Whether Claim 19 is anticipated under 35 U.S.C. §102(b) or is unpatentable under 35 U.S.C. 103(a) based on Nagle et al. U.S. Patent 4,915,908 (hereinafter "Nagle").

VIII. GROUPING OF CLAIMS

Regarding Issue 1 above, Claims 18, 20-23 and 25 contain different claim element limitations, are patentable separately because of one or more different claim element limitations, and accordingly, do not stand or fall together.

IX. PRIOR ART OF RECORD

The following is a listing of the prior art of record relied upon in the rejection of claims under appeal.

Nagle et al. U.S. Patent 4,915,908 (hereinafter "Nagle")

X. ARGUMENTS FOR REVERSAL

Claims 18, 20-23 and 25 - 35 U.S.C. §102(b)

Claims 18, 20-23 and 25 stand finally rejected under 35 U.S.C. §102(b) as anticipated by Nagle et al. U.S. Patent 4,915,908.

Nagle discloses a method for the production of a composite comprising a distribution of second phase particles in a metal, metal alloy, or intermetallic final matrix.

Appellants' claims as amended require finely sized metal carbide particles selected from the group consisting of Sc, Hf, Nb, Mo, and V finely sized metal carbide particles. These metal carbides are not taught or suggested by Nagle.

Appellants respectfully submit that the rejection of Claims 18, 20-23 and 25 under 35 U.S.C. §102(b) as anticipated by Nagle et al. U.S. Patent 4,915,908 should be reviewed.

Claim 19; 35 U.S.C. §102(b) and §103(a)

Claim 19 stands finally rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Nagle.

Claim 19 as amended requires a final product, a metal matrix having a uniform distribution of finely sized metal carbide particles having an average particle size of less than about 0.3 microns, the finely sized metal carbide particles selected from the group consisting of Sc, Hf, Nb, Mo, and V and the finely sized metal carbide particles (from Claim 18). Nagle does not disclose or suggest such metal carbide particles.

Appellants submit that the rejection of Claim 19 under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Nagle should be reviewed.

The Nagle reference discloses a Direct Addition Process which adds a <u>powder</u> of titanium, e.g., a compact, to aluminum as molten aluminum and powder aluminum. See Nagle Examples 1-5, col. 16-17.

The Nagle additives are added as a separate phase, i.e., in

a solid phase powder different from the molten phase of the matrix.

The Nagle process is highly exothermic and difficult to control.

Appellants' invention requires a product formed by providing a molten composition of aluminum metal liquid and metal liquid, wherein Sc, Hf, Nb, Mo, and V metal liquid is provided in the molten composition as a liquid and not as a powder.

Accordingly, the Nagle et al. Direct Addition Process of adding Ti powders is significantly different from Claim 1, as amended, which requires a liquid state process wherein the Sc, Hf, Nb, Mo, and V metal liquid provided in the molten composition as a liquid and not as a powder.

The significant difference of liquid and not powder is important to bring the components of Sc, Hf, Nb, Mo, and V and carbon into an intimate reactive contact in the liquid state as set forth in Appellants' specification.

Nagle does not teach a uniform cluster-free distribution of no more than two particles attached to one another at a magnification of 500X. The importance of the difference is found in the fact that although conventional ceramic phase formation processes in metal may offer some possibilities for the production of a wide range of reinforcement particle types and improved compati-

bility between the reinforcement and the matrix, the in-situ formed ceramic particles in metal are too large, e.g., on the order of several microns, and are found to form clusters. In-situ formed ceramic particles having these sizes, i.e., of several microns, are candidates for use as reinforcement in a composite, but are not suitable for use as dispersoids for recrystallation control, for dispersion strengthening, or for use as a component for structure refinement. Appellants have found, on the other hand, that the novel ceramic dispersoid in metal product of the present invention provides a uniformly dispersed product of finely sized ceramic phase particles dispersed in-situ in a metal matrix having a uniform cluster-free distribution of no more than two particles attached to one another at a magnification of 500X.

Nagle does not teach the volume of matrix aluminum metal or the volume of Sc, Hf, Nb, Mo, and V carbide ceramic phase particles.

Claim 19 is rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Nagle.

Claim 19, requires a final product, a metal matrix having a uniform distribution of finely sized metal carbide particles having an average particle size of less than about 0.3 microns,

the finely sized metal carbide particles selected from the group consisting of Sc, Hf, Nb, Mo, and V and the finely sized metal carbide particles (from Claim 18). Nagle does not disclose or suggest such metal carbide particles.

Appelants submit that the rejection of Claim 19 under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Nagle should be reviewed.

Appellants' finely sized metal carbide particles have an average particle diameter of less than about 1 micron formed and dispersed in situ in the final aluminum metal matrix, which is nowhere taught or suggested by Nagle.

A 40 volume percent of a uniform distribution of finely sized Sc, Hf, Nb, Mo, and V carbide ceramic phase particles formed and dispersed in-situ in the final aluminum metal matrix is nowhere taught or suggested by Nagle.

Appellants' ceramic phase titanium carbide particles have an average particle diameter of less than about 0.3 micron formed and dispersed in situ in the final aluminum metal matrix, which is nowhere taught or suggested by Nagle.

A 30 volume percent of a uniform distribution of finely sized titanium carbide ceramic phase particles formed and dispersed in-situ in the final aluminum metal matrix is nowhere taught or suggested by Nagle.

Less than about 10 volume percent of a uniform distribution of finely sized titanium carbide ceramic phase particles are formed and dispersed in-situ in the final aluminum metal matrix of Appellant's invention as claimed, which is nowhere taught or suggested by Nagle. Less than about 5 volume percent of a uniform distribution of finely sized titanium carbide ceramic phase particles are formed and dispersed in-situ in the final aluminum metal matrix is nowhere taught or suggested by Nagle.

Less than about 0.5 volume percent of a uniform distribution of finely sized titanium carbide ceramic phase particles are formed and dispersed in-situ in the final aluminum metal matrix of Appellant's invention as claimed, which is nowhere taught or suggested by Nagle.

For the foregoing reasons, the rejection of Appellants' Claims under 35 U.S.C. §103(a) as unpatentable over Nagle et al. U.S. Patent No. 4,915,9086 is based on an insufficient reference is respectfully requested to be reversed.

Appellants' invention provides a novel liquid-state dispersoid-forming process, novel ceramic particle dispersoids formed in-situ in metal by the liquid-state process, and novel products containing the ceramic particle dispersoids formed in-situ in metal by the liquid-state process. Appellants' invention as claimed, as amended, provides a novel product for producing a

material containing uniformly dispersed, finely sized ceramic phase particles, e.g., such as Sc, Hf, Nb, Mo, and V carbide particles, formed in-situ in metal by a novel liquid-state dispersoid-forming process.

Appellants' invention as claimed, as amended, provides a novel liquid-state-in-situ-formed ceramic dispersoid in metal product produced by the process of providing a molten composition of molten aluminum metal / alloy and molten Ti metal, wherein the Sc, Hf, Nb, Mo, and V metal is provided in molten composition Sc, Hf, Nb, Mo, and V as a liquid and not as a powder.

The significant difference of liquid and not powder is important to bring the components of titanium and carbon to reactive contact in the liquid state in the process of the present invention. A high density uniform dispersion of very small dispersoid particles is provided by the final product of Appellants' invention.

The product of Appellants' invention is very dense, e.g., on the order of 98% to 99% or higher. Porosity is undesirable in the product of Appellants' invention as claimed, as amended. The importance of the high density, essentially non-porous product produced in accordance with Appellants' claims, as amended is found in providing a porosity-free material for producing aluminum castings.

XI. CONCLUSION

For the foregoing reasons, Appellants respectfully submit that Claims 18, 20-23 and 25 are patentably distinguishable under 35 U.S.C. §103(a) over the cited references of Nagle et al. U.S. Patent 4,915,908 and respectfully request reversal of the 35 U.S.C. §103(a) rejection.

For the foregoing reasons, Appellants respectfully submit that Claim 19 is patentably distinguishable under 35 U.S.C. §103(a) or 35 U.S.C. §102(b) and respectfully request reversal of the 35 U.S.C. §102(b) or 35 U.S.C. §103(a) rejection.

Respectfully submitted,

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XI. APPENDICES

Appendix A - Claims on Appeal

18. A ceramic dispersoid in metal product, comprising:

(a) a matrix metal of aluminum and

(b) a uniform distribution of finely sized metal carbide particles having an average particle size of less than about 0.3 microns, said finely sized metal carbide particles selected from the group consisting of Sc, Hf, Nb, Mo, and V and said finely sized metal carbide particles formed and dispersed in-situ in said metal matrix.

19. The ceramic dispersoid in metal product of claim 18 wherein said finely sized ceramic particles are formed by the process of:

(a) providing a molten composition comprising a matrix liquid of aluminum or aluminum alloy metal and at least one of said carbide-forming elements;

(b) providing a chloride salt containing carbon particles, wherein said salt comprises NaCl and KCl in a weight/weight ratio within the range of about 0.8-1.2 and of $MgCl_2$ and $CaCl_2$ in amounts comprising up to about 5-10% by weight of the salt mixture; and

(c) reacting said chloride salt containing carbon particles in said molten aluminum alloy by vigorously stirring said aluminum alloy and said chloride salt containing carbon particles to form a mixture of said molten metal liquid in contact with a portion of said carbon particles at an elevated temperature above the liquidus of the aluminum alloy to form a unagglomerated distribution of finely sized ceramic phase particles having an average particle diameter of less than about 0.3 microns formed and dispersed in-situ in an aluminum metal matrix.

20. The ceramic dispersoid in metal product of claim 18 wherein said finely sized metal carbide particles are selected from the group consisting of ZrC, VC and combinations thereof.

21. The ceramic dispersoid in metal product of claim 18 wherein said matrix metal is aluminum or aluminum alloy.

22. The ceramic dispersoid in metal product of claim 18 wherein said finely sized metal carbide particles are scandium carbide.

23. The ceramic dispersoid in metal product of claim 18 wherein said finely sized metal carbide particles are vanadium carbide.

25. The ceramic dispersoid in metal product of claim 18 wherein said finely sized metal carbide particles are molybdenum carbide.